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SHORT COMMUNICATION

REPLY TO DISCUSSION ON 'THE EUROPEAN SOIL EROSION MODEL (EUROSEM): A DYNAMIC APPROACH FOR PREDICTING SEDIMENT TRANSPORT FROM FIELDS AND SMALL CATCHMENTS'

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ABSTRACT

It is considered that EUROSEM is already able, in principle, to replicate all the combinations of detachment and transport considered by Kinnell's discussion, with suitable parameter values. Some effects will only be reproducible when EUROSEM contains a more explicit representation of particle sizes. A minor error in the manuscript is acknowledged. Copyright © 1999 John Wiley & Sons, Ltd.

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Kinnell (1999) proposes that the complex processes of soil particle detachment by raindrop impacts and flow erosion consist of four modes. It is customary to describe erosion as being composed of 'rill' and 'interrill' processes. In EUROSEM (Morgan *et al.*, 1998) we considered the processes of detachment and transport operating on interrill and rill areas to be composed of essentially the same mechanisms, with the contribution of sediment from splash and flow detachment being controlled by the hydraulic, soil and rainfall characteristics at any particular time during a storm. We are confident that EUROSEM simulates all four modes of detachment described by Kinnell (1999).

For mode (1), flow detachment–flow transport (FD–FT), there should be a low value of splash detachability k, and a high value (e.g. 1·0) for the flow detachability coefficient, β. This will produce the situation that Kinnell describes of flow erosion in the absence of splash detachment.

For mode (2), raindrop detachment–flow transport (RD–FT), there should be a high value of k and a low value of β, resulting in excess transport capacity. Here we would expect the reverse of mode (1) with only splashed material contributing to the transported sediment.

Mode (3), raindrop detachment–raindrop-induced flow transport (RD–RIFT), will occur with reasonable values of k, low or zero values of β, and low or zero values of transport, i.e. exactly the conditions described at

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the top of p. 537 in our paper (Morgan *et al.*, 1998). In reality, here, particle entrainment and deposition are occurring simultaneously. When EUROSEM is extended to deal explicitly with particle size, it will be possible to entrain fine particles and detach coarse ones, exactly as Kinnell (1999) describes.

Mode (4), raindrop detachment–splash transport (RD–ST), is precisely the situation described by Equation 26 in our paper (Morgan *et al.*, 1998). There are no presumptions in EUROSEM about 'aerial' movement of particles, nor do we feel this is needed.

If the output from EUROSEM is examined in detail, it should be possible to interpret what mode of erosion is occurring at any particular time on any given plane. What is not known is whether the modes of detachment simulated by EUROSEM with a selected (or optimized) set of parameter values correspond to those actually occurring at the time. It should also be possible to set up EUROSEM to simulate conditions in experiments designed to investigate each mode (though there may be some scale problems associated with laboratory-sized plots).

In conclusion, we cannot agree with Kinnell's points concerning the splash and flow detachment within EUROSEM, as we believe them to be unfounded. Theoretically, EUROSEM can simulate the conditions described by Kinnell, but it will need to be validated before we know whether it can do so in practice. Since, as Kinnell states, the four modes of erosion may all occur within one storm and sometimes simultaneously, we envisage field validation may be difficult to achieve. We would be interested in knowing the outcome should anyone wish to attempt it.

Finally, Kinnell (1999) has correctly identified an error in the manuscript concerning the units of h in Equation 24 as described in our paper (Morgan *et al.*, 1998). We state the water depth (h) is in metres. In the paper by Torri *et al.* (1987), h is in millimetres, not metres, and our paper incorrectly gives 'm' rather than 'mm' as units for the same variable.

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